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ABSTRACT

This paper reports the results of a think-aloud study that investigated the comprehension processes of 10 Chinese English as a Second Language college students as they read texts in English. All participants were asked to read two English passages and think aloud as they read them. After reading each passage, the students answered 20 multiple-choice questions and performed a retelling task. Researchers compared the think-aloud data with participants' scores on the multiple choice test. Data analysis indicated that some participants, who performed the same or similarly on the multiple choice tests, actually employed quite different reading strategies, while other participants, whose scores on the multiple choice tests were different, actually used quite similar reading approaches. The think-aloud protocol revealed the participants' attitudes toward the text passages. It also highlighted how each particular strategy was used by participants and whether it was used effectively. Three appendixes present the two reading passages and a strategy classification scheme. (Contains 22 references.) (SM)

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A Think-Aloud Study of Chinese ESL Readers

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Abstract

The purpose of this paper is to report the results of a think-aloud study that investigated the comprehension processes of ten Chinese students as they read texts in English. Recently, the think-aloud method has been used with increasing frequency in the study of both first and second language reading processes. The essence of the think-aloud procedure is that the reader verbalizes his/her thoughts while reading a text, which allows researchers to get direct access to the on-line processes in text comprehension. In this study, all the participants were asked to read two English passages and think aloud while reading the texts. After reading each of the two passages, they also answered twenty multiple-choice questions and performed a retelling task. By comparing the think-aloud data with participants' scores on the multiple-choice tests, the researcher found that some participants who performed the same or similarly on the multiple-choice tests actually employed quite different reading strategies, while some participants whose scores on the multiple-choice tests were different actually used quite similar reading approaches. Moreover, the think-aloud protocols also revealed the participants' attitudes toward the test passages. Finally, the think-aloud data allowed the researcher to see how each particular strategy was used by the participants and whether it was used effectively. All of these findings suggest that the think-aloud method can be a useful technique to assess students' learning, especially when it is used in conjunction with other assessments.

Introduction

In the last few decades, the focus of both first and second language reading research has gradually shifted from the product of reading (such as a score on a multiple-choice test) to the process of reading, i.e., strategies used by readers to accomplish various reading tasks. Carrell (1991) points out that "reading strategies are of interest for what they reveal about the ways readers manage interactions with written text and also for how strategies are related to reading comprehension" (p. 167). Existing studies on reading strategies have mainly focused on: (1) the identification and classification of reading strategies used by first and second language readers (Bereiter & Bird, 1985; Block, 1986; Hosenfeld, 1977; Olshavsky, 1976-77; Sarig, 1987); (2) the

7439

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relationship between students' use of reading strategies and reading ability (Anderson, 1991; Block, 1986, 1992; Carrell, 1989; Hosenfeld, 1977; Padron & Waxman, 1988); (3) the transfer of reading strategies from a first language to a second language (Barnett, 1988b; Block, 1986; Carson & Carrell, 1992; Knight, Padron, & Waxman, 1985; Koda, 1990; Sarig, 1987); and (4) the improvement of students' reading ability through strategy training (Barnett, 1988a, 1988b; Carrell, Pharis & Liberto, 1989).

As more researchers become interested in the mental processes of readers, a research procedure called the think-aloud method has been increasingly used to investigate the mental processes that readers use to understand the printed word. In think-aloud studies of reading, subjects read and pause at intervals (e.g., at the end of each clause, each sentence, or each paragraph) to report what they are thinking and doing while reading a text. Next, the verbal reports are tape and/or video recorded for transcription. The transcripts of these spoken records of mental processes, called protocols, are then analyzed for patterns. Finally, based on the patterns, researchers make generalizations about the reading process. Because the essence of the think-aloud method is "the reporting of thoughts as they occur" (Bereiter & Bird, 1985, p. 132), many researchers see this research procedure as an unique opportunity to get a direct view of what is actually going on in the reader's mind.

Despite the increasing popularity of the think-aloud method, there has always been controversy over the use of this technique to investigate the mental processes of the reader. For instance, critics of the think-aloud method have pointed out that the verbalization may interfere with the reading process. In order to report, the reader has to interrupt the reading process at intervals and turn his/her attention from reading. In addition, the verbalization of the process increases the amount of information the reader must hold in his consciousness, which may cause cognitive overload (Block, 1998). Furthermore, the validity of the think-aloud protocols is constrained by the reader's ability to describe his/her thought processes. If readers have limited linguistic skills (for example, young children or L2 readers), they may not be able to describe their thought processes adequately. Consequently, the verbal reports may be incomplete or inaccurate (Brown & Lawton, 1977; Cohen, 1987; Miller & Bigi, 1979).

In response to these criticisms, many researchers recommend that the think-aloud method be used in conjunction with other measures (Block, 1998; Matsumoto, 1994). That is, by comparing the think-aloud protocols with data obtained through other research measures, researchers can ensure the validity of the data and, at the same time, compensate for the problems inherent in each method. Thus, when conducting a study to investigate the comprehension processes of Chinese ESL readers, this researcher used several measures, including the think-aloud method, to collect data. The purpose of

this paper is to report the results of that study, with a focus on comparing the information provided by think-aloud protocols and the data obtained through other assessments.

Methodology

Participants

Ten Chinese ESL students from Taiwan participated in this study. At the time of the study, they were attending the University of Kansas in the U.S. Three of them were Ph.D. students, six of them were Master's students, and one was an undergraduate student. All except one had completed their undergraduate education in Taiwan. They had all been in the U.S. for some time already; the longest duration of residence was five years, the shortest was one year. Their TOEFL scores, which ranged from 550 to 647, indicated that their English proficiencies were either at the intermediate or the advanced level. Although the one undergraduate student, Frances, had not taken the TOEFL by the time of this study, the fact that she passed the English proficiency examination for international students at KU seems to indicate that her English proficiency level was equivalent to that of the others.

Data Collection Procedures

During the study, the participants met with the researcher three times individually. In the first session, they first received training on thinking aloud. Then they were asked to read the first passage "Talking to Babies" (See Appendix A) and think aloud while reading the text. A red dot was placed at the end of each sentence to remind them to respond. Participants were allowed to think aloud either in English or Chinese so that their English oral proficiency would not interfere with their ability to report their strategies. After reading the passage, they were asked to answer 20 multiple-choice questions and to perform a retelling task. In the second session, participants read the second passage "Noise Pollution" (See Appendix B), but, otherwise, the procedures were exactly the same as in the first session. Finally, in the third session, I interviewed each participant about his/her English-learning experiences. For the purpose of this paper, however, only the data from the first two sessions will be examined and discussed.

Data Analysis

The researcher reviewed each of the think-aloud protocols and coded them for the use of reading strategies. Block's (1985) list of reading strategies was used as a starting point in coding the protocols. After the protocols were coded, additional strategies which were reported by the participants in this study, but were not accounted for by Block's coding system were categorized and added to the list of strategies.

Once the final coding system was developed (See Appendix C for the final classification scheme with the definitions and sample responses of strategies), the think-aloud protocols were coded again to classify strategies, and the frequency with which each strategy was used was also counted. The results of this analysis revealed the types of strategies used by each participant and how often he/she used a particular strategy.

The retelling protocols were also scored based on the checklists developed in Block's 1985 study. The protocols were scored for presence of a thesis statement and the number of main ideas and details recalled by the participants.

Findings

By comparing the think-aloud protocols with the data obtained from the multiple-choice tests and retelling tasks, the researcher found some interesting phenomena. For example, the researcher found that some participants who performed the same or similarly on the multiple-choice tests actually employed quite different reading strategies while some participants whose scores on the multiple-choice tests were different actually used quite similar reading approaches. Moreover, the think-aloud protocols also revealed the participants' attitudes toward the test passages. Finally, the think-aloud data allowed the researcher to see how each particular strategy was used by the participants and whether it was used effectively.

To illustrate how the think-aloud protocols combined with other measures can provide us with insights into readers' mental processes, the rest of the paper will first present data on two participants who performed the same on the multiple choice tests but employed quite reading strategies. Then the researcher will compare two other participants who had different scores on the multiple-choice tests but used quite similar reading approaches. After that, data on one participant whose attitude significantly affected her understanding of the texts will be presented.

Henry Versus Chris

Henry, who was 27 years old, was an MA student majoring in Mechanical Engineering. Chris was a 29-year-old MA student in Journalism. They had the same scores on the two multiple-choice tests (see Table 1). They both scored 95 on the first multiple-choice test and 80 on the second multiple-choice test. However, they performed differently on the retelling tasks. When retelling the first passage, Henry recalled only two of the seven main ideas in the passage. In contrast, Chris recalled five of the seven main ideas in the passage. Similarly, on the second passage, Henry remembered only 3 of the 6 main ideas, but Chris remembered 5 of them. In addition, Henry did not even mention the thesis of the second passage in his telling. The ways they recalled the information were also different. Chris's retelling protocols tended to

follow the text structures of the passages; that is, he first recalled the main idea of each paragraph and then the details that supported the main idea. In contrast, Henry's retelling protocols were less organized. He often remembered details but then either forgot or was mistaken about the main point that the details supported. All the information suggests that though they had the same scores on the multiple-choice tests, their reading processes might be quite different. To find out exactly what they did as they read, we have to look at their think-aloud protocols.

Table 1. Scores for multiple-choice tests and retelling tasks between Henry and Chris

	Multiple-Choice		Retelling Task 1			Retelling Task 2		
	Test 1	Test 2	Thesis	Main Idea (n=7)	Detail (n=13)	Thesis	Main Idea (n=7)	Detail (n=13)
Henry	95	80	+	2	7	-	3	5
Chris	95	80	+	5	7	+	5	6

Note: + = thesis statement present; - = thesis statement absent

When reading the two test passages, Henry's main approach was translating and paraphrasing the text sentence by sentence. When a sentence was long, he divided the sentence into smaller parts, translated or paraphrased each part, and then paraphrased or translated the whole sentence (See the example below)*. His decoding was meticulous; he hardly skipped a word when he translated or paraphrased a sentence. Since he devoted most of his attention to the decoding process, he hardly spent time responding to the information.

He read	He said
When talking to 1- and 2-year olds, adults usually raise the pitch of their voices and adopt a "sing-song" intonation, in which the voice rises and drops dramatically, often ending a sentence at a high point.	When talking to ... *when talking to one year olds and two year olds, talking to babies, then adults* ...
Reread "usually raise the pitch of their voice and adopt a sing-song intonation"	*that is, we adults usually will* raise the pitch. *Here, the word* "pitch," *I am not sure what he is talking about. But it can mean that they change our* voice, to raise ... *that is, to raise our* ... Pitch *refers to voice at different degrees. Then ... hmm ... that is, he [they] will raise their tone or something* ...

* When performing the think-aloud task, many of the participants chose to report their reading processes in Chinese or in a combination of Chinese and English. For the convenience of the readers, I translated their responses into English. Meanwhile, to distinguish the parts where the participants responded in English from the parts where they responded in Chinese and to prevent readers from confusing the translation with rereading, I italicized the responses made in Chinese.

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Reread "And adopt a sing-song intonation"	*That is ... and will ... that is, to match some ... I cannot say "match" ... here, the word "*adopt*", I don't know how to translate it. But, it means matching something like sing-song intonation.*
Reread "in which the voice rises and drops dramatically"	*That is, the intonation is like* voice rise and drop, *raise and ... go up and down ...* dramatically, dramatically, *it's like ... how to say it ... regarding the plot of a story, or something, like performance or something like that. I don't know how to translate it. It's ...* drama *... like* drama ... dramatically, *I don't know how to say it in Chinese. Anyway, it's dramatically, just like some ... hmm ... just like some ... like operas ... not like operas ... like some plots ... like that kind of intonation ... they will have ... because of the* performance, *they have to go up and down, up and down ... that is, some more obvious intonation. Then often, this voice, this dramatic voice ...*
Reread "... often ending a sentence ..."	*often ending a ... when ending a sentence ...*
Reread " ... at a high point ..."	*that is, use a high ... a relative high ... that is to say, the sentence is getting higher and higher gradually.*

Unlike Henry, Chris seldom translated word by word. Instead, he often just paraphrased the essence of the meaning rather than every detail in the sentence. He focused on gathering information from the text. Sometimes, he even created a question regarding an important concept and then tried to gather further information as he read along. For example, after reading the first sentence of the passage "Talking to Babies," he immediately recognized the importance of understanding the concept of "baby talk." He then persistently looked for relevant information in the text to gain an understanding of "baby talk."

He read	He said
All of the world's languages, from English to Urdu, share one special kind of speech: baby talk.	*When I read the first sentence, because I do not have* background *about* baby talk, *I will pay special attention to how the following text is going to explain what* baby talk *is.*

Recent research has confirmed that in spite of the great differences among cultures and languages, the general properties of speech used with babies who are learning to talk remain the same.	*What is said in the second sentence is connected to the first sentence. I cannot find the answer. I can only ... It presents a question to you. It says why* babies who are learning to talk remain the same. *That, I don't know. I have to continue ... keep these two questions in mind*--baby talk, *and why they want to, uh, and why* babies who are learning to talk remain the same. *I want to continue to look for answers in the following text.*
Baby talk sounds different from adult speech.	*Oh, the second paragraph gives me some clues to find the answers. It says that it's different from adult speech. Then what's the difference? I will continue to read.*
When talking to 1- and 2-year olds, adults usually raise the pitch of their voices and adopt a "sing-song" intonation, in which the voice raises and drops dramatically, often ending a sentence at a high point.	*I probably know what* baby talk *is. Then what is it like? For instance, it* ...which the voice rises and drops dramatically. *Then I probably know. I saw the way babies and mothers talked before; therefore, I probably have some* background *about what* baby talk *is.*
(Imagine the way you would say to a baby, "Hi, Johnny. You're playing with your teddy, aren't you?")	*Oh, it gives me an example.* Hi, Johnny ... *Then I probably will imagine how mothers ... what kind of tone they would probably use to say this sentence*

Another difference between Henry's and Chris' reading approaches is that they dealt with their reading problems differently. When Henry encountered a vocabulary problem or had difficulty understanding a sentence, he often made persistent efforts to solve the problem by rereading. For instance, he had a great difficulty understanding one of the sentences in the passage "Talking to Babies": "The child's presence—giving evidence of comprehension, boredom, or pleasure—was necessary to elicit 'true' baby talk from the mothers." The main problem was that he did not understand the meaning of the word "elicit" and the relationship between this word and the prepositional phrase "from the mothers." To solve this problem, he reread the sentence or different portions of the sentence over and over again. During the process, he actually gave up twice and tried to read on. The first time he gave up, he read on to the next sentence. The second time, he read through the whole article and then returned to this sentence. However, both times, he did not attempt to use the context to solve the problem. Instead, he just returned to the same sentence and reread it again and again. Despite repeated readings, he still could not figure out the meaning of the sentence.

In contrast, when Chris had difficulties understanding a sentence or a portion of a sentence, he tended to read on and guess the meaning from the context. In some cases, Chris even went beyond the immediate context to interpret a sentence. For example,

when he read sentence #32 in the passage "Noise Pollution," he could not really grasp the meaning. The first thing he tried to do was to look for the connection between this sentence and the sentences immediately before and after it.

He read	He said
The sound of all this is not very encouraging.	*The beginning of the following paragraph,* "The sound of all this is not very encouraging," *this sentence is very abstract to me. I cannot connect this sentence with what was written before. I have to think a while about what it tries to say. Uh-uh. I cannot understand what connection there is between this sentence and what was written before. Therefore, I have to see what connection there is between it and the next sentence.*

After this failed, he tried to read through the paragraph in the hope that the context of the whole paragraph would help him to understand this sentence. However, after he read through the last paragraph, he still could not understand the sentence. He then tried to guess the meaning from the perspective of the whole discourse. By recognizing the text structure and integrating information from the whole article, he was finally able to interpret the sentence correctly.

> After I read through the paragraph, I come back to think about what the first sentence is trying to say. Uh, the sound of all this is not very encouraging. (A pause). The sound of this ... Right now I don't know whether the sound has meaning beyond the words, or meaning between the lines, or is the sound ... Exactly what kind of sound is it? So, I don't understand what kind of sound it is, what it refers to. I may have to think about it. The first few paragraphs I just read ... (A pause) Then I think this sentence ... since this paragraph is an ending, the sound of this should say how all the effects of noise on humans, which were mentioned before, uh, physical, psychological, and intellectual, all of this .. The sound should be the psychological and physical effects of noise on humans. Therefore I want to say "the sound of this" ... uh ... "this" probably is ... "the sound" probably is the trend ... "the sound of this" probably ... This sentence is ... I guess, it's completely based on a guess. Based on the previous portion of the text, my guess is that the "the sound of this" should be what was mentioned before, the effects of noise on humans physically, psychologically, and intellectually, does not sound very optimistic, not very encouraging. This ... After reading it through, I guess this is probably the meaning of this sentence.

In addition, these two readers were also different in terms of the degree to which they made effort to integrate information. What Henry mostly did was decoding individual sentences. He did not make much effort to connect information. Sometimes, his paraphrases of consecutive sentences were disconnected and did not make sense when put together, but he did not seem to be aware of it. It was as though the new information and the old information were unrelated, or he did not keep the old information in his mind while he continued to read. Furthermore, he treated each

sentence the same and did not distinguish the main idea from the details. To illustrate these problems, the following were his responses to the last paragraph of the passage "Talking to Babies."

He read	He said
Roger Brown (1977) suggests that there is something else baby talk can do besides helping babies learn to talk: It can express affection in ways that normal speech can't.	*That is, this kind ... there is another kind of thing that can help ... That is, he suggests that there are some, there are some other things that can help babies learn to talk.* It can express affection in ways ... *What kind of* way? *It can express a kind of influence* in ways ... *that is, use some methods, use some that can't ... some normal methods can't express ... it can* ... It can express affection, *some influences.*
He points out that sometimes baby talk occurs between adults, but that such behavior is usually limited to lovers.	*He points out ... sometimes ... adults ... it means that adults'* baby talk, *the baby talk that occurs between adults ... but these things only happen to some* lovers *that they like, some people that they like. If it's people that they don't like, they won't like to ... won't ... I cannot say "won't." It means that they will be less likely to have this kind of* baby talk.
And this may be as important a function as language learning and communication.	*And this may be one ... this may be ... it means that this may be as important ... that is, the importance of language learning and communication ... it's an important* function *when communicating and learning language.*
Children need to learn to talk.	*Children need to learn to talk.*
They need to understand "Stay away from the stove" and "Don't eat the Swedish ivy."	*They need ... It means that they need to understand stay away ... that is, don't ...* Swe-... Swedish, Swedish ivy, *this is a kind of food, probably bad food or what. ... not bad food, just don't each too much of it, or don't ... that is,* stay away from the stove.
But they also need to hear "I love you" and to feel the meaning of these words even before the words themselves are actually understood.	*It means that but they also need to hear something more sentimental like* "I love you," *that is, more ... they need some advice, but they also need people to express love, then .. even these words they have actually understood long ago, have been understood by them, even so, they still need to understand these things.*

On the contrary, Chris did not view each sentence separately. Instead, he tried to understand the meaning of each sentence through the context of the discourse. In the

following example, Chris was reading the second paragraph of the second passage "Noise Pollution." As soon as he read the first sentence, he recognized that this sentence contained the main idea of the paragraph. Thus, as he continued to read the rest of the paragraph, he viewed the other sentences either as examples or explanations to prove the point presented at the beginning of the paragraph.

He read	He said
For one thing, high level of noise can literally be deafening.	*I was right. The following is going to be about the effects on humans' hearing. The first sentence of the second paragraph.*
The Environmental Protection Agency estimates that more than 16 million people in the United States suffer from hearing loss caused by noise	*The second sentence extends the information in the first sentence. That is ... It says that hearing will be affected, and so it gives an example immediately. Because of noise pollution,* 16 million *people will lose hearing or have hearing problems.*
When the cells of the inner ear are bombarded with loud sounds, they can be damaged, leading to hearing loss.	*It extends the information about why ... the third sentence explains why the hearing is lost. It's that the cells of the inner ears are damaged by very loud noise. The whole sentence is ... the same ... From my point of view, every sentence of it is closely connected to each other, one sentence leading to another. Therefore, I feel that it's easy to understand.*
Even a relatively mild noise level of 70 decibels (see table below), about the level of a cocktail party, can damage hearing if one is subjected to it year in and year out.	*Then the next sentence, it says ... This sentence and the previous sentence appear the same to me because it only explains the effects on hearing. It only gives more scientific ... examples of scientific experiments to prove the point in the first sentence.*

Finally, their awareness of comprehension processes also varied. Since Henry focused on sentence-level meaning, he did not closely monitor his comprehension of the text-level meaning. For example, when he read the last paragraph of the passage "Talking to Babies," he either misinterpreted or failed to understand several sentences in the paragraph (See the think-aloud protocols on page 9). However, he did not seem to be aware of his comprehension problems.

Compared to Henry, Chris monitored his comprehension quite frequently. This was related to his reading purpose—gathering information. In order to gather information, he had to assess constantly whether he understood the text and whether the information he was reading was relevant. Moreover, when comprehension was hindered, he usually was able to reflect on the reading process and develop plans to solve the problems. Sometimes, he reread. Sometimes, he used background

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knowledge to extend and explain information in the text. More often, he read on to get more information in succeeding sentences. The following example illustrates that he constantly assessed his understanding of the text, reflected on his reading process to come up with plans, and applied strategies to help himself understand.

He read	He said
In this and other studies, David Glass and Jerome E. Singer found that the predictability and controllability of the noise made a big difference in subjects' reactions to it.	*Oh, the next paragraph, the fourth paragraph, its* predictability and controllability of noise ... *This sentence, I understand its surface meaning, but I don't know what* predictability and controllability of the noise *are. Then I have to look for answers in succeeding sentences. I will keep* "predictability" *and* "controllability" *in mind, and then try to see what* predictability and controllability of the noise *refer to.*
When subjects knew when the loud noise was coming, its harmful aftereffects were greatly reduced.	*Then after I read the second sentence, I know what* predictability *is. Because it says here, it says if you know this person, how loud his screaming is, you will be a little bit prepared mentally, then the damage will be smaller. That's probably it.*
And when subjects knew they could stop the noise if they wanted to, the effects were also reduced--even though they didn't actually make use of their "stop" button.	*Oh, the next is about* controllability. *If you turned the radio up to 110 decibels, but you can, you have the ability to turn it down, then the damage will be smaller. So these two sentences are to explain what* predictability and controllability *are. After I read these two sentences, I know what* predictability and controllability *are.*
You are probably much less bothered by the clatter of your own typewriter than you are by that of your roommate's, since in the former case you have direct control over the noise.	*Then the third sentence continues to explain the effect of* controllability *on humans by giving an example. If you can* control, *then the effect on you will be smaller. It gives an example about the* typewriter. *So, after the example is given, I have a deeper understanding of* controllability.

To sum up, Henry devoted most of his attention to decoding individual sentences; he was primarily concerned with sentence-level meaning. As a result, though he understood and remembered many details in the articles, he often failed to recognize the main points. In contrast, Chris's reading purpose was to gather information from the text. Therefore, he focused on understanding the text-level meaning. To achieve this goal, he had to make connections between sentences, distinguish between main ideas and details, and constantly monitor his comprehension.

Wayne Versus Frances

In contrast to Henry and Chris, who had the same scores on the multiple-choice tests, Wayne and Frances performed quite differently on the multiple-choice tests. Wayne got 85 on both the multiple-choice tests. Frances, on the other hand, got 65 on the first multiple-choice test and 70 on the second test (see Table 2). Despite the difference in their performance on the multiple-choice tests, their think-aloud protocols seem to indicate that they used very similar reading approaches.

Table 1. Scores for multiple-choice tests and retelling tasks between Wayne and Frances

	Multiple-Choice		Retelling Task 1			Retelling Task 2		
	Test 1	Test 2	Thesis	Main Idea (n=7)	Detail (n=13)	Thesis	Main Idea (n=7)	Detail (n=13)
Wayne	85	85	+	3	5	-	4	1
Frances	65	70	-	2	5	+	0	6

Note: + = thesis statement present; - = thesis statement absent

First of all, both of them read in a linear fashion. That is, they processed the text word by word, phrase by phrase, and then sentence by sentence. This tendency was especially evident when they responded to a long sentence. The following excerpts are Wayne's and Frances' responses to the same sentence, sentence #2 in the passage "Talking to Babies." The protocols indicate that they both broke the sentence into smaller parts and decoded them one by one.

Wayne

He read	He said
Recent research has confirmed that in spite of the great differences among cultures and languages, the general properties of speech used with babies who are learning to talk remain the same.	*The second sentence probably meant, recent research, can* confirm, *can confirm, in spite of, in languages, the great differences among cultures and languages, the general properties, the general properties of speech, uh, the speech used by babies when they are learning to talk, have general properties, generally are almost, not almost, still remain the same, the same. That is to say, baby, baby's speech, speech used by babies, has general, common properties.*

Frances

She read	She said
Recent research has confirmed that in spite of the great differences among cultures and languages, the general properties of speech used with babies who are learning to talk remain the same.	*I have to go back and read it one more time. This sentence ... oh, the differences between* culture *and* language, *and then ... oh,* baby learning to talk, *uh,* remain the same. *Uh, it means .... I am not making sense. ... O.K., oh, when I read it the second time, I found that here it talks about differences, that is, differences between* culture *and* language, *then it says, uh, this* baby, *he is learning, when he is learning to talk, uh ...* general properties of speech, *uh, this ... uh, that is, he ... uh, how to say this? Basic* properties ... General properties, the general properties *of his speech, uh, of the baby, if he is learning to talk, then keep the* same thing, *that is, the same.*

Secondly, they hardly integrated information. In other words, they both focused more on understanding individual sentences than on gathering information from the text. When reading the first passage, Wayne used the strategy of Integration only 3% of the time, and Frances only 4% of the time. Similarly, when reading the second passage, they both used the strategy of Integration only 2% of the time.

Most important of all, they showed little awareness of their reading processes. For example, when Wayne read sentence #2 in the first passage, he translated the term "baby talk" as either "嬰兒的語言" or "嬰兒的談話", both of which meant the talk of babies in Chinese. However, this translation was not correct because in the text, the author used "baby talk" to refer to the talk adults use with babies. Despite the fact that the author described the way adults talked to babies throughout the text, Wayne continued to translate "baby talk" as the talk of babies. Not until he read sentence #22, which specifically said that the "child's presence ... was necessary to elicit try baby talk from the mothers," did he notice the inconsistency between his interpretation of "baby talk" and the context surrounding it. The fact that Wayne could go on mistranslating "baby talk" for such a long time without noticing this mistake was surely caused by his failure to integrate information. However, another important reason should be that he did not monitor his comprehension process closely. Otherwise, he would have noticed the problem much sooner. Similarly, Frances misinterpreted a great deal of information in both passages. However, she seldom made connections between sentences, nor did she check whether her interpretations of individual sentences were consistent with each other. As a result, sometimes her paraphrases of continuous sentences, when put together, did not make much sense; however, she often could not detect the problems. For example, when she read the last paragraph of the second

passage "Noise Pollution," she misinterpreted sentences #35 (It's possible to combat this trend) and #36 (One way is by encouraging the production of quieter jets, trucks, cars, and appliances). Her interpretation of these two sentences was that it was possible for all of us to become deaf by the year 2000 because we produced different kinds of cars. Then, as she continued to read sentence #37 and #38, she paraphrased them correctly. Her interpretation was that despite the invention of quieter machines, people didn't necessarily want them. Although the paraphrases of these two sentences were actually in conflict with her interpretations of the previous two sentences, she did not even notice the inconsistency.

In contrast to the similarity revealed by the think-aloud protocols, their scores on the retelling protocols presented conflicting results (see Table 2). On the one hand, their scores on the first retelling task were indeed similar. When retelling the first passage, Wayne remembered the thesis statement and three of the seven main ideas. Frances also recalled only two of the seven main ideas. On the other hand, their scores on the second retelling task were quite different. Wayne identified four of the six main ideas in his retelling protocol, but he remembered only one detail from the article. In contrast, Frances remembered none of the main ideas in the article, but she remembered six details. The difference in the scores seemed to indicate that they employed quite different reading approaches when reading the second passage. However, when looking at their retelling protocols more closely, the researcher found that this was not completely the case. First of all, although Wayne remembered four of the six main ideas, he did not follow the text structure when retelling the passage. Instead, he mixed up much of the information in the second half of the article. For example, he confused the information about the psychological effect with information about the effects on intellectual abilities (e.g., reading ability). Here is part of his retelling protocol: "For psychological disadvantage, they can make people unable to work properly in intellectual work, such as poor reading skill and poor cognitive ability." In addition, he remembered only one detail in the article. These findings seemed to indicate that he had difficulty relating the supporting details to their corresponding main ideas. In contrast, Frances could not identify any of the main ideas in the article probably because of her limited vocabulary. For instance, she failed to understand "devastating" and "hazards" in the first paragraph, "deafening" in the second paragraph, " psychological" in the third paragraph, and "intellectual" in the fifth and the sixth paragraphs. Many of these words were key words in the topic sentences of these paragraphs. Hence, though she could remember some details from the article, she could not relate the details to any of the main ideas because she did not understand the main ideas as such. Thus, what caused the difference between Wayne and Frances on the retelling task seemed to have more to do with their language proficiency levels than

reading approaches. Wayne had a better understanding of the article because he could decode most of the sentences correctly. However, both Wayne and Frances did not recognize the text structure well and could not relate the supporting details to the main points in the article.

Martha

Among the ten participants, Martha was the one who made the most emotional reactions. In fact, her think-aloud protocols as well as her scores on the multiple-choice tests and retelling tasks suggest that her attitudes toward the two reading passages significantly affected her understanding of the passages. More specifically, when the article was saying something she agreed with, she felt motivated to read. However, when the article was saying something she could predict or something she didn't like, she would feel bored and impatient; as a result, she would not look at the content closely. Unfortunately, the first passage "Talking to Babies" contained a lot of information that she either was not interested in or did not agree with. For example, after reading the first sentence of the second paragraph, she immediately determined that she already knew what this paragraph was about and commented that she felt like skipping this paragraph. As she continued to read to the third paragraph, she started to develop a negative attitude towards the author and the text. She either disagreed with or criticized information in almost every sentence of that paragraph. At the end of this paragraph, she commented,

> ... To tell the truth, I feel that the point of this paragraph is just the author's personal opinion. Some part of it is right, and then ... uh ... Because sometimes the child does not need high pitch, he still will smile. Then you don't need to raise the voice at the last word, he will know it's his turn, if you stop talking. Even though you do not raise your voice and you just keep talking without stopping, he will ... probably ... because he does not know when he should talk, he may interrupt and talk. Therefore, I think that this paragraph is just the research, research done by himself. Then ... no comments.

As she continued to read, this negative attitude became even worse. After she responded to sentence #16, she made it clear that she did not feel like continuing to read because she disagreed with most of the information in the text.

She read	She said
The grammatical simplicity and concreteness of baby talk help make the structure and rules of language clearer to someone just starting to learn it, and they help ease communication with a small person who cannot yet understand much speech.	*Oh, this paragraph, I certainly agree because this paragraph is definitely common sense. Both children's grammar and vocabulary are not enough, therefore we have to simplify our* talk. *Oh, therefore, it will be easier for them to understand. My God! If it is like this, I will probably not continue to read. I may just jump to the first sentence of each paragraph. Because, up to this point, I disagree with 2/3 of the information in the text. Therefore, I probably will not feel like continuing to read. Perhaps I will read the first sentence of every paragraph. Now, I will read a little bit further.*

For the purpose of the study, she decided to read a little bit further. However, the more she read, the more her attitude towards the text and the author became hostile. This was most obvious when she read the last paragraph. For the first two sentences, she just challenged the information, but when she got to the last three sentences, she got so angry and impatient with the author that she regarded the information as "廢話" (In Chinese, 廢話 means a superfluous statement, a meaningless remark, rubbish).

This negative attitude towards the text and the author not only made her lose any desire to continue to read but also caused her not to look at the context closely, which often led to confusion or misinterpretation. For example, when she read sentences #21-#23, she had some difficulties understanding some of the information. After rereading the sentences and still not being able to figure out the meaning, she decided not to take any more action. Moreover, she did not consider herself responsible for not being able to resolve the reading problems. Instead, she blamed the author for not writing clearly.

Another thing that might cause her to misunderstand the text was her use of background knowledge. She misinterpreted "baby talk" as "the talk of babies" early in the passage, and this incorrect framework often caused confusion when she tried to understand the text. Moreover, since she focused only on the information she was interested in or agreed with, the information later in the text did not alert her to the fact that she had misinterpreted "baby talk." As a result, she only got 70 on the first multiple-choice test and only remembered two of the main ideas in the article when retelling the passage.

In contrast, Martha showed much more interest in reading the second passage and her comprehension of the passage seemed to be much better than that of the first passage. On the multiple-choice test, she got 90 points, and she recalled five of the six main ideas in the article. This was probably due to the fact that her knowledge of the

topic "Noise Pollution" was generally consistent with the information in the text, whereas in the case of the first passage, her assumption about baby talk constantly interfered with her comprehension of the passage.

Conclusion

The findings of the study suggest that the think-aloud method can be a useful research tool because it can provide information not available through other sources. For example, without the think-aloud protocols, the differences between Henry's and Chris' reading processes would have remained invisible, so would the similarities between Wayne's and Frances' reading approaches. Similarly, if we had not looked at Martha's think-aloud protocols, it would have been hard for us to explain why her scores on the first multiple-choice test and retelling task were so different from her scores on the tests for the second passage. In addition, the think-aloud protocols also revealed that a potentially positive strategy such as the strategy of using background knowledge could have a negative impact on readers' reading process if the framework created based on the knowledge was not correct. Despite its usefulness, the think-aloud method, like any other research measures, has drawbacks and limitations. For instance, participants' reports on their mental processes may not be complete. Therefore, it is best to use the think-aloud method in conjunction with other measures so that more accurate and complete information can be obtained. Finally, in addition to its value for research, thinking aloud can also be a wonderful instructional tool. Teachers can use this technique to assess students' learning. As we find out more about the reading processes and difficulties of our students, we will be in a better position to help them build on their strengths and overcome their weaknesses.

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Appendix A

Passage One: TALKING TO BABIES

[1]* All of the world's languages, from English to Urdu, share one special kind of speech: baby talk. [2] Recent research has confirmed that in spite of the great differences among cultures and languages, the general properties of speech used with babies who are learning to talk remain the same.

[3] Baby talk sounds different from adult speech. [4] When talking to 1- and 2-year olds, adults usually raise the pitch of their voices and adopt a "sing-song" intonation, in which the voice rises and drops dramatically, often ending a sentence at a high point. [5] (Imagine the way you would say to a baby, "Hi, Johnny. You're playing with your teddy, aren't you?")

[6] What is the point of these peculiarities? [7] Research has shown that babies prefer sounds in higher pitch ranges (Kearsley, 1973). [8] Adults may quickly learn that they are more likely to get a smile or a satisfied gurgle from a baby when they raise their voices a bit. [9] And the melodious rise and fall of the speech signal may hold the baby's attention -- something that isn't easy to do. [10] For the toddler who has begun to utter a few words, the rising voice at the end of the sentence serves as a signal: "Your turn." [11] It marks the end of the adult's verbal offering and invites the child to make a response.

[12] Adult speech to toddlers is also characterized by short sentences, limited vocabulary, and straight-forward grammar. [13] There are lots of questions and there is plenty of repetition (Snow, 1972). [14] Furthermore, speech to beginning talkers tends to be tied to the here and now, with few references to the past or future. [15] A father is much more likely to say, "See the birdie, Franny?" than "Do you remember the bird we saw yesterday?"

[16] The grammatical simplicity and concreteness of baby talk help make the structure and rules of language clearer to someone just starting to learn it, and they help ease communication with a small person who cannot yet understand much speech.

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* Sentence numbers were not included in the version read by the participants. They are included here for the readers' convenience.

[17] Adults seem to catch on to baby talk quite naturally. [18] Catherine Snow (1972) found that non-mothers (who had almost no experience with babies) made the same speech changes when they talk to babies that mothers did. [19] And Marilyn Shatz and Rochel Gelman (1973) found that even 4-year-old children will make similar speech modification when talking to 2 year-olds. [20] Babies themselves help to shape baby talk, through their reaction to adult utterances. [21] When mothers were asked to talk to an imaginary baby, they did not simplify their speech as much as when they spoke to a real one (Snow, 1972). [22] The child's presence--giving evidence of comprehension, boredom, or pleasure--was necessary to elicit "true" baby talk from the mothers. [23] True baby talk, with its particular grammatical simplifications, does not appear in parents until the baby is about 18 months old and begins to demonstrate some understanding of what is being said (Phillips, 1973).

[24] Roger Brown (1977) suggests that there is something else baby talk can do besides helping babies learn to talk: It can express affection in ways that normal speech can't. [25] He points out that sometimes baby talk occurs between adults, but that such behavior is usually limited to lovers. [26] And this may be as important a function as language learning and communication. [27] Children need to learn to talk. [28] They need to understand "Stay away from the stove" and "Don't eat the Swedish ivy." [29] But they also need to hear "I love you" and to feel the meaning of these words even before the words themselves are actually understood.

Appendix B

Passage Two: NOISE POLLUTION

[1]* American cities, with their screeching cars, thundering trucks, roaring subways, wailing sirens, blaring horns, and bellowing factories, are tremendously noisy places, and they are getting noisier. [2] Because of the devastating effects that sustained high level of noise can have on human functioning, noise pollution has become one of modern society's greatest environmental hazards.

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* Sentence numbers were not included in the version read by the participants. They are included here for the readers' convenience.

[3] For one thing, high level of noise can literally be deafening. [4] The Environmental Protection Agency estimates that more than 16 million people in the United States suffer from hearing loss caused by noise. [5] When the cells of the inner ear are bombarded with loud sounds, they can be damaged, leading to hearing loss. [6] Even a relatively mild noise level of 70 decibels (see table below), about the level of a cocktail party, can damage hearing if one is subjected to it year in and year out. [7] And higher levels of noise can have much worse effects. [8] In one study, guinea pigs were played blaring rock music (at about 110 decibels) for prolonged periods. [9] They suffered severe hearing loss, and it was later found that their inner ear's sensory cells "had collapsed and shriveled up like peas." [10] One disco owner reacted to the experiment with the comment, "Should a major increase in guinea-pig attendance occur at my place, we'll certainly bear their comfort in mind." [11] Unfortunately, analogous effects can take place in humans as well.

The column on the right shows the decibel intensity of some common sounds (Dempsey, 1975). A decibel is the smallest differences in intensity of sound that the human ear can detect. The scale is a mathematical power function. At around the middle of the scale, every increase of 10 decibels represents approximately doubling of sound intensity.

Approximate Intensity of some Common Sounds	
Rustling leaves	12
Human whisper	30
Normal conversation	50
City traffic	80
Subway train	95
Motorcycle	110
Rock band (amplified)	110
Snowmobile	115
Pain threshold	130
Sonic boom	130

[12] In addition to its effects on hearing, noise can have harmful psychological effects. [13] In one series of studies, students heard tape-recorded bursts of either extremely loud (110 decibels) or soft (56 decibels) noise over a period of 20 minutes (Glass and Singer, 1973). [14] After a short while, the subjects adapted to the noise, and they were able to perform clerical tasks successfully. [15] But the loud noise had unwelcome aftereffects. [16] Immediately after the noisy period, subjects who had heard the loud noise were impaired in their ability to work efficiently on problem-solving and proofreading tasks.

[17] In this and other studies, David Glass and Jerome E. Singer found that the predictability and controllability of the noise made a big difference in subjects' reactions

to it. [18] When subjects knew when the loud noise was coming, its harmful aftereffects were greatly reduced. [19] And when subjects knew they could stop the noise if they wanted to, the effects were also reduced--even though they didn't actually make use of their "stop" button. [20] You are probably much less bothered by the clatter of your own typewriter than you are by that of your roommate's, since in the former case you have direct control over the noise. [21] Unfortunately, most of the noise that pervades our cities is of the worst kind--it comes in unpredictable bursts, and it comes from sources over which we have no control.

[22] When noise continues over a period of years, it can have adverse effects on intellectual abilities. [23] In four New York City apartment buildings spanning a noisy highway, elementary school children who lived on the lower floors (where noises were louder) were found to have less ability to discriminate between sounds than children who lived on higher floors (Cohen, Glass and Singer, 1973). [24] Children on the lower floors also had poorer reading skills than those on the higher floors. [25] Glass and Singer suggest that in tuning out a noisy environment, children may fail to distinguish between speech-relevant sounds and speech-irrelevant sounds. [26] The unhappy result is that the longer children must endure noise, the more likely they are to ignore all sounds, and this, in turn, may make reading more difficult.

[27] Another study compared children who attended school near an airport, where they were subjected to the noise of aircraft landings and takeoffs at unpredictable times during the day, with children who attended an otherwise similar school in a quiet neighborhood (Cohen et al., 1980). [28] At both schools, the children were tested in a soundproof trailer. [29] Children from the noisy school were somewhat more likely to fail on a cognitive task (a puzzle) and they were more likely to give up before the time to complete the task had elapsed. [30] It appears that continued exposure to uncontrollable noise may induce a feeling of helplessness that can impair intellectual performance. [31] If children know that disturbing noise may be coming at any moment, it may be hard for them to persevere in their work.

[32] The sound of all this is not very encouraging. [33] And the noise levels of our cities--and, increasingly, of the countryside as well--are getting worse and worse. [34] By one extreme estimate, the urban sound level is increasing at the rate of 10 percent a year, enough to make us all deaf by the year 2000 (Dempsey, 1975). [35] It is possible to combat this trend. [36] One way is by encouraging the production of quieter jets, trucks, cars, and appliances. [37] As things stand, however, people don't necessarily want quieter machines. [38] One manufacturer found that people would not buy his newly designed quieter vacuum cleaner--since it didn't make a lot of noise, consumers assumed that it couldn't be doing a good job!

Appendix C
Strategy classification scheme

Strategy	Definition	Sample Responses
General strategies		
1. Anticipate content	The reader predicts what content will occur in succeeding portions of text.	"After I read the second sentence, I know what the whole article is probably going to talk about. The text that follows will describe the effects on humans."
2. Comment on text structure	The reader distinguishes between main points and supporting details or makes comments on the purpose of information.	"The third sentence explains why the hearing is lost."
3. Integrate information	The reader connects new information with previously stated content.	"The second sentence extends the information in the first sentence."
4. Question information in the text	The reader questions the significance or veracity of information in the text.	"If these non-mothers had no experience with babies, how would they learn to speak like baby talk? I wonder."
5. Make an inference	The reader makes an inference, draws a conclusion, or makes a hypothesis about the content.	"Why do adults want to learn baby talk? The third sentence of the third paragraph gives me an answer. It's because they want to please the baby."
6. Use background knowledge	The reader uses background knowledge or experience to understand the text, to evaluate the veracity of information, and to react to the information.	"Oh, of course. All the mothers talk to their babies in this way. They change the pitch of their voice. I agree."
*7. Acknowledge lack of background knowledge	The reader indicates that he/she does not have knowledge about a topic.	"I don't have background knowledge about baby talk."
8. Comment on behavior or process	The reader describes strategy use, indicates awareness of the components of the process, or expresses a sense of accomplishment or frustration.	"I will look for the answer in the text that follows. I will keep 'predictability' and 'controllability' in my mind, and then try to find out what 'predictability' and 'controllability' of noise are."
9. Monitor comprehension	The reader indicates that he/she is assessing his/her degree of understanding of the text.	"After I read these two sentences, I understand what predictability and controllability are."
10. Corrective behavior	The reader notices that an	"Originally I thought that he [the

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	assumption, interpretation or paraphrase is incorrect and changes that statement.	author] changed the subject here. However, he is still talking about babies, only that he is explaining that it [baby talk] has the function of expressing affection."
11. React emotionally	The reader reacts emotionally to information in the text.	"16 million people. That's an amazing figure."
Local strategies		
1. Paraphrase	The reader rephrases content using different words, but with the same sense.	"Because of noise pollution, 16 million people will lose hearing or have hearing problems." "它說這會影響 intellectual abilities"
*2. Translate a clause or sentence into L1	The reader expresses the meaning of a clause or sentence in Chinese.	"當噪音持續呢一年的期...超過一年以上的期間的話，那這種噪音呢，會...在智慧的能力上呢，會有反面的效果的。"
3. Reread	The reader rereads a portion of the text either aloud or silently.	"It says that for one thing, high level of noise can literally be deafening."
4. Question meaning of a clause or sentence.	The reader does not understand the meaning of a portion of the text.	"What does this sentence mean?"
5. Question meaning of a word or a phrase	The reader does not understand a particular word.	"What does the word 'toddler' mean?"
6. Word-solving behavior	The reader uses context, a synonym, or some other means to understand a particular word or phrase.	"Impaired. I think that it means not being able to deal with something smoothly. The word impaired, I never looked it up in the dictionary, but I could guess from the context that it probably means this."
*7. Use knowledge of grammar	The reader uses knowledge of grammar to understand a portion of the text.	Then I stop to think about "leading to hearing loss," this participial phrase should modify "ear," "inner ear" mentioned in the earlier part. Leading to hearing loss. Hmm ... but semantically, it should not be "ear," it should be "sounds," because it's the sounds that lead to hearing loss, not the ears that lead to hearing loss. Therefore, on the second thought, it should modify the word "sounds."

* These strategies were added by the researcher in response to the think-aloud data generated by the participants.

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